


LUT 1  
AWARD R06-FC07-0001-0001

## On-line Laser-Ultrasonic Measurement System



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LUT 2  
AWARD R06-FC07-0001-0001

## Goal



- To measure the **wall thickness** and **eccentricity** of steel tubing as it is being produced.
- To use the LUT measurements to **reduce tube eccentricity** and **achieve size** with fewer set-up pieces.

LUT 3  
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## Concept

Laser Energy => Ultrasonic Pulse  
+  
Time of Flight & Acoustic Velocity  
+  
Position Measurement  
=  
Wall & Eccentricity

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## Partners



- The Timken Company  
Alloy Steel Business
- National Research Council Canada  
Industrial Materials Institute
- Oak Ridge National Laboratory  
Instruments & Controls Division




LUT 5  
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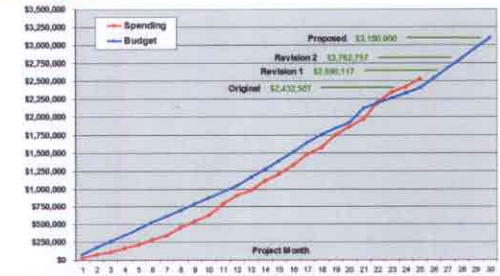
## Scope

- With six months remaining on the **2.5-year schedule**, the project is entering the prototype demonstration phase.
- The revised project budget is **\$3.1 million** with Timken providing the industrial cost share.






LUT 6  
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## Budget




Revision	Budget (\$)
Original	2,432,507
Revision 1	2,890,117
Revision 2	3,783,757
Proposed	3,100,000

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### Technologies Demonstrated in R&D


- Fiber-based laser ultrasonics to generate the sound pulse
- Laser-based velocimetry to measure sampling position
- Enhanced signal analysis to extract reflected signals from noise

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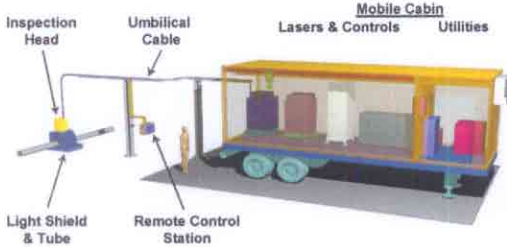
### Technologies Demonstrated in Plant

- Pattern recognition to identify causative factors of eccentricity
- Wireless telemetry to signal flashlamps to power up


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### Prototype Concept




Inspection Head  
Umbilical Cable  
Mobile Cabin  
Lasers & Controls  
Utilities  
Light Shield & Tube  
Remote Control Station


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### Cabin Interior




Rear section with umbilical cable  
Front section with chiller unit


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### System Components

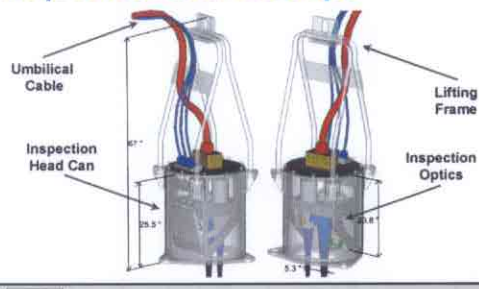


Generation laser with remote station and control unit  
Detection laser


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### Inspection Head Concept



Umbilical Cable  
Inspection Head Can  
Lifting Frame  
Inspection Optics

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AWARD #GE-FCST-99013851

### Inspection Head

Optics, pyrometer and velocimeter

Protective windows in sealed cooling plate

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### Head Cooling & Shield Mount

Cooling channels

Light shield mounting bolts

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### Head Can & Lifting Frame

Rugged exterior with mounts and HMD saddle

Lifting frame and cable supports

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### Light Shield

Light shield/tube guide mounted in mill

Interior showing potential placement of ports

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### Calibration Box

Top sealing port to mate with inspection head

Front door access to place calibration units

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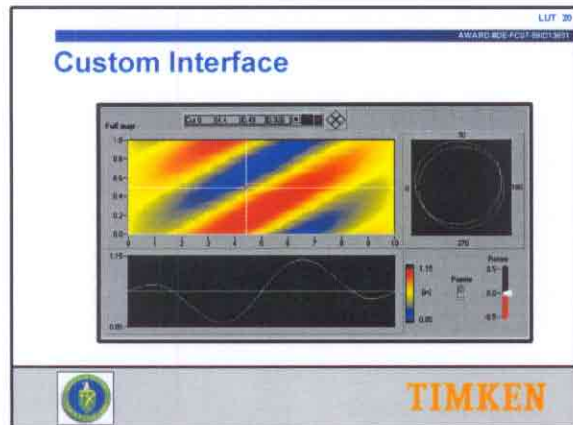
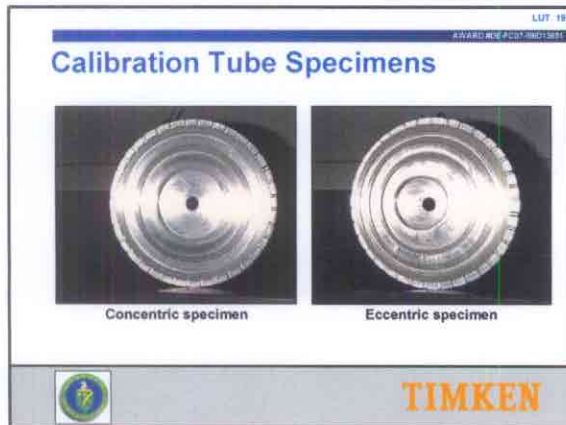
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### Calibration Units

Black body units

Speed wheel

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- LUT 21  
AWARD WBE PCST 80013001
- ### Schedule & Remaining Tasks
- ♦ Verify optics & data transfer (6/4)
  - ♦ Assemble components in cabin, conduct system & safety test (6/11)
  - ♦ Import & transfer to Timken (6/18)
  - ♦ Install & conduct training (6/25)
  - ♦ Calibrate (7/2)
  - ♦ Demonstrate & implement (7/9)
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- LUT 22  
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- ### Commercialization Partner Evaluation
- ♦ Vendor Interest
  - ♦ System Design
  - ♦ Timken Interest
  - ♦ Customer Interest
  - ♦ Ongoing Service
  - ♦ Data Processing
- 

- LUT 23  
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- ### Other applications
- ♦ In-line thickness measurements
    - Steel Bar & Wire
    - Aluminum
    - Glass
    - Wood & Paper
  - ♦ Laser-based velocimetry
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- LUT 24  
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- ### Summary
- ♦ All components acquired or built
  - ♦ Integration proceeding
  - ♦ System & safety tests pending
  - ♦ Customs & applications filed
  - ♦ Installation & implementation planned
  - ♦ Commercialization selection outlined
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